

The Germination and Longevity of Seeds in an Equatorial Climate

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Introduction

SINGAPORE is situated $1^{\circ} 17''$ North in latitude on the South side of Singapore Island. It has very uniform temperature, high humidity and copious rainfall (Colony of Singapore Annual Report). The mean temperature of the coolest month (December) is only 3°F lower than the hottest (May). The absolute minimum is 70°F and the absolute maximum 93°F , but these are rarely reached. The normal range is 75° – 80°F on a wet day and 74° – 89°F on a dry day. (Holttum, 1953). The rainfall is between 85 and 118 inches per year. Its distribution varies from year to year, but there is a maximum fall in the months December–January and generally a short period of drier windy weather in late January or February. However, a month in which less than $2.5''$ rainfalls is rare, and occurs about every two years in the February–March or the July–September periods.

Crocker and other workers at the Boyce Thompson Institute have made extensive investigations on the conditions most favourable for the storage of seeds and have found that most seeds require a low temperature and a low moisture content. (Crocker, 1948). The climate of Singapore may be expected to be unfavourable since the temperature and humidity are relatively high. Moreover, Singapore is characterised by having a continuous growing season. During the whole year the conditions are favourable for germination. The ability for seeds to undergo a period of dormancy during unfavourable conditions (as in temperate or monsoon climates) is not an essential feature for the survival of plants grown here. However, a large number of locally grown plants have been imported from other more seasonal climates and have seeds which normally undergo a resting period before germination takes place. Some such seeds may require a period of 'after-ripening' before germination can occur. It may be that the climate

is not suitable for this to take place and seed propagation of such plants cannot occur here.

It is probable that the majority of seeds germinate shortly after they reach the ground, but it is interesting to investigate the survival period of those which may have fallen in a place unfavourable for germination. Such results are also interesting from the horticultural point of view since a gardener may not find it convenient to plant freshly gathered seed immediately. Seeds which do not degenerate under Singapore conditions in storage can be safely stored until required.

Experiments

Ripe seeds of various local and imported tropical plants were collected and carefully dried by exposure to the air. The percentage germination of the sample was obtained by placing a number (which varied from 20–150 according to the availability of the seed) on filter paper in a petri dish. The filter paper was kept moist throughout the experiment with distilled water. Certain seeds showed a tendency for mould infection and these were first washed with 2 per cent saturated mercuric chloride for two minutes and then in running water. The final washing was in distilled water. The seed samples were stored in glass specimen tubes with tightly fitting corks. At monthly intervals a number of seeds was removed from each sample and the percentage germination found as before. An equal number was scarified by scraping the testa with a scalpel and these were placed in another germinator.

Results

1. Percentage Germination/Age

The *total percentage germination* was taken to be the percentage of the total number of seeds employed which germinated in a reasonable period of time. In general, germination was complete in a few days, but 50 days were necessary for fresh seeds of *Asclepias curassavica* L. and a longer time was required for fresh seeds of *Dianella ensifolia* Red. (108 days). These two cases illustrate the need for a dormant period by some fresh seed. The time required for germination of older samples kept a few months in storage was much shorter.

There is no significant difference between the results for unscarified and scarified seeds, hence the long time required for germination is not due to slow permeability of the seed coat. The seeds as collected were not ready for immediate germination and required a period of after-ripening.

TABLE I

Age of Sample	0 month	1 month	2 months	3 months
<i>Asclepias curassavica</i> L.				
No. of days before germination begins ..	35	21	15	10
No. of days for total per cent germination ..	50	30	21	15
Total percentage germination	100	100	100	100
<i>Dianella ensifolia</i> Red.				
No. of days before germination begins ..	108	61	35	—
No. of days for total per cent germination ..	108	65	42	—
Total percentage germination	100	100	26	—

The results for scarified seeds in the case of *Asclepias curassavica* L. were as follows:—

TABLE II

Age of Sample	0 month	1 month	2 months	3 months
No. of days before germination begins ..	36	19	13	9
No. of days for total per cent germination ..	48	27	25	20
Total percentage germination	100	100	100	100

It was not possible to obtain results for scarified seeds in the case of *Dianella ensifolia* Red. since scratching of the coat seemed to interfere with the normal process of germination, causing distorted growth. It is interesting to note that the total period required

for germination to take place whether the seeds are kept in the wet germinator or dry in storage is roughly the same. However, dry storage is unfavourable, and after 2 months storage the percentage germination was reduced to 26. After 3 months none of the seed was viable.

TABLE III

Period required for germination of *Dianella ensifolius* Red.

DRY		WET	TOTAL
0	+	108	108 days
31	+	65	96 „
62	+	42	104 „

It seems that these seeds require a considerable period of after-ripening before they can germinate. If the dry storage is too long there is degeneration. For best results these seeds should be planted not later than a month after they have been gathered.

The following table gives the total per cent germination of various species after certain periods of storage. The seeds in each case were gathered from the fruiting plant as far as could be judged immediately prior to the normal dispersal time. Unless all seeds germinated immediately samples were left at least 50 days in the germinator before the total per cent was calculated. In the following table the percentage germination of scarified seeds is only given if it differs significantly from the unscarified results.

A large number of species which show an initial high percentage germination degenerate rapidly on storage in the Singapore climate. The seeds of *Melastoma malabathricum*, *Muntingia calabura*, *Fagraea fragrans*, *Nepenthes gracilis* and *Nephelium malaiense* will not remain viable after a month in dry storage. The first four named possess very small seeds which may not be able to withstand such conditions of imposed dormancy. In the case of *Nepenthes gracilis* seeds kept for only 14 days failed to germinate. *Nephelium malaiense* is, on the other hand, a tree of Malayan origin, and climate makes it possible for immediate germination of the seeds. The seeds lack the ability to remain dormant over even a short period of time, but possession of such a character would have no particular selective advantage.

TABLE IV

Name	Family	PER CENT GERMINATION AFTER MONTHS STORAGE										
		0	1	2	3	4	5	6	7	8	9	10 mths.
<i>Abroma augusta</i> L.	Sterculiaceae	100	80	60	0	0	0	..	..	..	..	..
<i>Achras Zapota</i> L.	Sapotaceae	50	8	0	0	0	..	..	..	..	0	0
<i>Adenanthera pavonina</i> L. (not scarified)	Leguminosae	100	62	41	30	18	9	5	3	0	100	100
.. (scarified)	..	100	100	100	100	100	100	100	100	100	100	100
<i>Allium odorum</i> L.	Liliaceae	100	81	61	44	12	0	0	0	100	100	100
<i>Asclepias curassavica</i> L.	Asclepiadaceae	100	100	100	100	100	100	100	100	100	100	100
<i>Basella rubra</i> L. (not scarified)	Chenopodiaceae	100	100	100	100	100	100	100	100	100	100	100
.. (scarified)	..	75	62	3	0	..	..	..	..	..	..	..
<i>Bixa orellana</i> L.	Bixaceae	80	65	0	0	100	..	..	..	..	..	..
<i>Calliandra haematocephala</i> Hassk.	Leguminosae	100	100	100	100	100	0	0	0	..	..	..
<i>Carapa guianensis</i> Aubl.	Meliaceae	100	81	26	0	0	..	..	..	..	..	..
<i>Cassia mimoides</i> L.	Leguminosae	100	100	100	0	0	0	0	0	..	..	..
<i>Cooperanthus</i> (Cooperia X <i>Zephyranthes</i>)	Amaryllidaceae	100	100	100	100	51	12	0	0	..	..	..
<i>Cordia cylindristachys</i> Roem. and Schult. (not scarified)	..	100	63	0	..	..	..	..	..	..	..	..
.. (scarified)	..	33	45	35	40	36	42	28	0	..	..	..
<i>Cosmos sulphureus</i> Cav.	Compositae	67	65	63	60	61	60	68	42	0	..	..
<i>Dianella ensifolia</i> Red.	Liliaceae	30	25	12	0	0	0	..	..	0	..	..
<i>Fagraea fragrans</i> Roxb. (with fresh sap)	Loganiaceae	100	100	26	0	..	..	..	..	..	..	..
<i>Gossypium arboreum</i> L.	Malvaceae	100	0	0	..	..	..	..	..	..	..	..
<i>Hippeastrum equestre</i> Herb.	Amaryllidaceae	100	70	21	0	0	0	..	..	..	..	..
<i>Melastoma malabathricum</i> L. (washed)	Melastomaceae	614	405	221	167	0	0	..	..	..	..	..
<i>Muntingia calabura</i> L. (washed)	Tiliaceae	90	0	0	0	0	0	..	..	..	..	..
<i>Nepenthes gracilis</i> Korth.	Nepentaceae	615	0	0	0	..	..	..	..	..	..	..
<i>Nephelium malaiense</i> Griff.	Sapindaceae	83	0	0	..	..	..	..	..	..	..	..
<i>Ocimum basilicum</i> L.	Labiatae	33	0	0	..	..	..	..	..	..	..	..
<i>Pithecolobium affine</i> Baker	Leguminosae	100	100	75	48	0	..	..	..	0	..	..
<i>Quamoclit pinnata</i> Boi.	Convolvulaceae	100	100	100	100	100	61	23	0	0	..	..
<i>Ricinus communis</i> L.	Euphorbiaceae	24	35	20	39	40	19	35	125	10	15	100
<i>Spathodea campanulata</i> Beauv.	Bignoniaceae	100	100	100	100	100	100	100	100	100	100	100
<i>Urena lobata</i> L. (not scarified)	Malvaceae	100	100	94	80	72	55	31	27	20	18	15
.. (scarified)	..	80	73	68	59	50	36	42	40	..	..	35
<i>Zephyranthes tubispata</i> Herb.	Amaryllidaceae	100	95	83	93	100	97	86	100	..	..	100

Note.—The seeds of *Fagraea fragrans* Roxb. failed to germinate unless supplied with fresh fruit sap. All the other seeds were tested in the absence of any fruit sap. In the case of *Melastoma malabathicum* L. and *Muntingia calabura* L. extra washing was required, since the presence of a low concentration of the fruit sap may modify the results. This will be the subject of a further communication.

The following table gives the time required for the whole sample to become inviable.

TABLE V
Time for Complete Degeneration

0-1 month	1-2 months	2-3 months
Melastoma malabathricum L. Muntingia calabura L. Nepenthes gracilis Korth. Nephelium malaiense Griff. Fagraea fragrans Roxb.	Achras zapota L. 'Cooperanthes'	Abroma augusta L. Basella rubra L. Calliandra haematocephala Hassk. Gossypium arboreum L. Carapa sulphureus Cav. Dianella ensifolia Red. Zephyranthes tubispatha Herb.
3-4 months	4-5 months	5-6 months
Hippeastrum equestre Herb.	Allium odorum L. Bixa orellana L. Ocimum basilicum L.	Cassia mimosoides L.
6-7 months	7-8 months	9 months and over
Pithecolobium affine Baker.	Cordia subcordata Lam.	Asclepias curassavica L. Adenanthera pavonina L. Quamoclit pinnata Boj. Ricinus communis L. Spathodea campanulata Beauv. Urena lobata L.

Seeds of *Asclepias curassavica* L. can be kept for at least 10 months without any degeneration of the seed (100 per cent germination after 10 months storage). In the case of *Adenanthera pavonina* L. the seeds also remain viable but become irreversibly impermeable with time, and if they are more than 8 months old do not germinate at all unless the testa is cracked. This may be the reason why Guppy (1912) states that these seeds are impermeable, and that Corner (1949) emphasises the importance of strong-beaked birds, such as parrots, in cracking the hard red coat prior to germination. However, not all fresh seed of *Adenanthera* is impermeable. Some seeds will germinate immediately, and others

will germinate at varying intervals over a long period which may exceed 6 months—the period between the production of one crop of seed and the next.

Quamoclit pinnata Boj. does not give a good initial germination (24 per cent) but at 9 months 15 per cent of the seed is still viable. *Ricinus communis* L. parallels *Asclepias curassavica* L. in its behaviour. Scarified seeds germinate more quickly, but the final percentage germination is the same. The testa of *Ricinus communis* L. is 'slowly permeable' and scratching of it reduced the time required for germination. *Spathodea campanulata* Beauv. shows 100 per cent germination initially but after 10 months only 15 per cent is obtained. *Urena lobata* L. remains viable but the testa becomes impermeable. Such change in permeability of the testa is a very good adaptation to this climate in which permeable seeds degenerate rapidly (most of those listed above are permeable). Seeds which are initially permeable can germinate rapidly if the conditions are suitable, but if this is not the case the testa may become impermeable which will enhance the keeping properties of the seed.

TABLE VI

Name	AGE IN MONTHS										
	0	1	2	3	4	5	6	7	8	9	10 mths.
<i>Abroma augusta</i> L. ..	8	7	9	..	..	..	..	..	..	..	..
<i>Achras zapota</i> L. ..	15	15	..	..	..	..	..	..	..	..	..
<i>Adenanthera pavonina</i> L. (not scarified) ..	1	2	1	1	1	2	1	1	..	..	..
(scarified) ..	1	2	1	1	3	1	1	1	1	2	1
<i>Allium odorum</i> L. ..	2	3	2	2	3	..	..	..	..	..	..
<i>Asclepias curassavica</i> L. ..	35	21	15	10	8	9	10	7	10	9	8
<i>Basella rubra</i> L. (not scarified) ..	13	12	14	..	..	..	..	..	..	..	..
(scarified) ..	9	12	..	..	..	..	..	..	..	..	..
<i>Bixa orellana</i> L. (with aril) ..	3	2	4	2	3	..	..	..	..	..	..
(without aril) ..	3	2	4	5	3	..	..	..	..	..	..
<i>Calliandra haematocephala</i> Hassk. ..	2	1	2	..	..	..	..	..	..	..	..
<i>Carapa guianensis</i> Aubl. ..	14	12	14	..	..	..	..	..	..	..	..
<i>Cassia mimosoides</i> L. ..	1	1	1	1	1	2	..	..	..	..	..
'Cooperanthes' ..	6	6	..	..	..	..	..	..	..	..	..
<i>Cordia subcordata</i> Lam. (not scarified) ..	14	14	10	18	10	14	12	..	..	..	..
(scarified) ..	16	15	18	14	12	13	18	20	..	..	..
<i>Cosmos sulphureus</i> Cav. ..	3	5	2	..	..	..	..	..	..	..	..
<i>Dianella ensifolia</i> Red. ..	108	61	35	..	..	..	..	..	..	..	..
<i>Fagraea fragrans</i> Roxb. ..	12	..	..	..	..	..	..	..	..	..	..
<i>Gossypium arboreum</i> L. ..	3	3	2	..	..	..	..	..	..	..	..
<i>Hippastrum equestre</i> Herb. ..	10	11	10	10	..	..	..	..	..	..	..
<i>Melastoma malabathricum</i> L. ..	5	..	..	..	..	..	..	..	..	..	..
<i>Muntingia calabura</i> L. ..	10	..	..	..	..	..	..	..	..	..	..
<i>Nepenthes gracilis</i> Korth. ..	11	..	..	..	..	..	..	..	..	..	..
<i>Nephelium malaiense</i> Griff. ..	7	..	..	..	..	..	..	..	..	..	..
<i>Ocimum basilicum</i> L. ..	3	2	4	3	..	..	..	..	..	..	..
<i>Pithecellobium affine</i> Baker ..	4	4	3	4	4	3	4	..	..	..	..
<i>Quamoclit pinnata</i> Boj ..	2	3	2	4	5	5	2	3	3	3	3
<i>Ricinus communis</i> L. ..	3	3	3	3	3	3	3	3	3	3	3
<i>Spathodea campanulata</i> Beauv ..	4	5	5	4	6	6	6	6	5	6	6
<i>Urena lobata</i> L. ..	8	5	4	4	4	4	4	5	4	4	4
<i>Zephyranthes tubispatha</i> Herb. ..	11	10	11	..	..	..	..	..	..	..	..

Cordia subcordata Lam. may be placed in a class of 'variably permeable' (Guppy 1912). It seems that 30-40 per cent of the seeds gathered are permeable and germinate without scarifying the endocarp, about 30 per cent are impermeable but viable, and about 40 per cent are inviable.

2. Time taken for Germination/Age

Two times were recorded in each instance—(a) the time taken after the seed is placed in the germinator before germination begins; (b) the time for all viable seeds to germinate.

(a) The time in days before Germination begins/age of Seed

Except for *Asclepias curassavica* L. and *Dianella ensifolia* Red. which have been described previously, provided some seeds remain viable storage does not affect the time taken for germination to begin. Table VII gives the time from planting for all viable seeds to germinate.

(b) The time for total percentage Germination (Table IV) Age of Seed

TABLE VII

Name	AGE IN MONTHS										
	0	1	2	3	4	5	6	7	8	9	10 mths.
<i>Abroma augusta</i> L. ..	8	8	9	..	..	..	..	..	..	..	..
<i>Achras zapota</i> L. ..	20	19	..	..	..	..	..	..	..	..	..
<i>Adenanthera pavonina</i> L. (not scarified) ..	436	101	72	53	21	10	5	4	..	..	..
(scarified) ..	3	4	4	5	5	4	4	3	..	..	..
<i>Allium odorum</i> L. ..	16	16	18	16	17	..	..	..	..	..	..
<i>Asclepias curassavica</i> L. ..	50	30	21	15	..	..	..	..	..	..	..
<i>Basella rubra</i> L. ..	23	20	14	..	..	..	..	..	..	..	..
<i>Bixa orellana</i> L. (with aril)	7	5	4	7	4	..	..	..	..	..	..
(without aril) ..	4	3	4	5	5	..	..	..	..	..	..
<i>Calliandra haematocephala</i> Hassk.	2	3	2	..	..	..	..	..	..	..	..
<i>Carapa guianensis</i> Aubl. (not scarified)	20	19	21	..	..	..	..	..	..	..	..
(scarified) ..	7	6	7	..	..	..	..	..	..	..	..
<i>Cassia mimosoides</i> L. ..	4	5	4	4	4	4	..	..	..	..	..
'Cooperanthes' ..	6	6	..	..	..	..	..	..	..	..	..
<i>Cordia subcordata</i> Lam. (not scarified)	20	15	20	20	10	16	21	..	..	..	..
(scarified) ..	17	22	19	21	15	18	18	21	..	..	..
<i>Cosmos sulphureus</i> Cav. ..	5	7	8	..	..	..	..	..	..	..	..
<i>Dianella ensifolia</i> Red. ..	108	65	42	..	..	..	..	..	..	..	..
<i>Fagraea fragrans</i> Roxb. (with fresh sap) ..	16	..	..	..	..	..	..	..	..	..	..
<i>Gossypium arboreum</i> L. ..	3	4	4	..	..	..	..	..	..	..	..
<i>Hippeastrum equestre</i> Herb. ..	16	18	14	17	..	..	..	..	..	..	..
<i>Melastoma malabathricum</i> L. ..	10	..	..	..	..	..	..	..	..	..	..
<i>Muntingia calabura</i> L. ..	26	..	..	..	..	..	..	..	..	..	..
<i>Nepenthes gracilis</i> Griff. ..	14	..	..	..	..	..	..	..	..	..	..
<i>Nephelium malaiense</i> Griff. ..	7	..	..	..	..	..	..	..	..	..	..
<i>Ocimum basilicum</i> L. ..	5	6	7	5	..	..	..	..	..	..	..
<i>Pithecellobium affine</i> Baker ..	4	4	4	4	4	4	4	..	..	..	..
<i>Quamoclit pinnata</i> Boj. ..	3	5	4	3	6	7	6	5	5	6	3
<i>Ricinus communis</i> L. ..	3	3	3	3	4	3	3	3	3	3	3
<i>Spathodea campanulata</i> Beauv. ..	13	10	11	13	14	10	11	6	12	13	11
<i>Urena lobata</i> L. (not scarified)	18	12	6	4	3	4	4	4	4	3	4
(scarified) ..	2	3	4	5	4	4	4	4	5	4	4
<i>Zephyranthes tubispatha</i> Herb. ..	11	10	11	..	..	..	..	..	..	..	..

In general, storage does not alter the time required for all viable seeds to germinate. A change in the time period required appears to be due to two factors. The fresh seeds may be immature, e.g. *Asclepias curassavica* and *Dianella ensifolia*, or there may be a change in the permeability of the seed coat, e.g. *Adenanthera pavonina* and *Urena lobata*. When a large sample of *Adenanthera* seeds is collected from the fruiting tree and 100 or so seeds are placed in the germinator, they do not all germinate immediately as the following data shows.

Percentage germination of fresh *Adenanthera* seeds/time in days.

TABLE VIII

After	1 day	1%	germination	After	50 days	60%	germination
"	2 days	3%	"	"	74	66%	"
"	3	4%	"	"	87	69%	"
"	4	5%	"	"	105	72%	"
"	5	8%	"	"	124	78%	"
"	7	16%	"	"	139	82%	"
"	8	19%	"	"	154	86%	"
"	9	20%	"	"	155	87%	"
"	10	21%	"	"	169	89%	"
"	11	22%	"	"	180	91%	"
"	12	23%	"	"	183	92%	"
"	14	29%	"	"	189	93%	"
"	26	39%	"	"	196	94%	"
"	28	41%	"	"	208	95%	"
"	31	48%	"	"	293	97%	"
"	33	52%	"	"	392	99%	"
"	36	56%	"	"	436	100%	"
"	39	56%	"				

If however, 100 seeds are scarified and placed in the germinator all germinate in 4 days. It seems that a sample of freshly gathered *Adenanthera* seeds consists of about 5 per cent immediately permeable seeds, but the other seeds will become permeable in damp conditions. In this way the time of germination of any one crop of *Adenanthera* seeds is spread over a long period of time even if the seeds fall immediately on ground suitable for germination. If the seeds are cracked by strong-beaked birds, etc., they will germinate immediately. In dry storage however, the seeds become irreversibly impermeable but not inviable (since they germinate when scarified). The time needed for the few seeds which can still become permeable even if not scarified to germinate is reduced.

*Fresh seeds of
Adenanthera*
(impermeable)

Wet conditions
All germinate with time.
(become permeable)

Dry conditions
Will not germinate after 8
months.
(become impermeable)

The testa of *Carapa guianensis* is not impermeable but is sufficiently thick to hinder germination. The unscarified fresh seed takes 20 days to germinate whereas the scarified ones can be induced to germinate in 7 days. *Urena lobata* is like *Adenanthera* in its behaviour. The seed-coat tends to become impermeable in dry storage, and after 10 months only 35 per cent unscarified seed will germinate. The seed-coat of fresh seed causes some delay in immediate germination (18 days is required as compared with two in the scarified sample), and as with *Adenanthera* dry storage tends to cause the coat to become irreversibly impermeable.

Discussion and Conclusions

Akamine (1951) conducted an interesting series of experiments on the seeds of *Tristania conferta*. As a result he was able to plot graphs of per cent germination against years of storage at 3 different temperatures (45°F, 59°F and 75°F), coupled with 3 different humidities (30 per cent, 75 per cent and 90 per cent). He showed clearly that the seeds kept best at the lowest temperature, but the keeping capacity was greatly reduced at high humidities. The results for 75°F need only concern us here, although the temperature of storage of the seeds described above was rarely as low as this. At 30 per cent humidity 2/3 of the originally viable seeds germinated after 4 years storage; at 75 per cent humidity nearly all the seeds failed to germinate; and at 90 per cent humidity germination failed to occur if the seeds were kept for only 9 months. The last conditions (90 per cent humidity and 75°F) can be compared with the conditions normally present in Singapore. For the greater part of a 24 hour period the humidity is well above 90 per cent and is only reduced to 60 per cent for a few hours on a hot, sunny day.

The results above indicate that in the high humidity and high temperature conditions of Singapore the seeds of most species tested failed to remain viable after a nine months period of storage. It may be inferred from the results of previous workers that under more favourable climatic conditions the seeds would remain viable for a longer period. However it is to be noted that a number of the species tested are plants of an equatorial climate in which there is a continuous growing season. In such a climate there is no selective advantage of seeds which can remain ungerminated for long periods of time. It may be that such seeds cannot be stored ungerminated even under conditions of lowered temperature and humidity. On the other hand the physiological activities

of the seed may be so slowed down that the seed *accidentally* possesses the property of longevity. Such conditions of low temperature and humidity will never occur in the plants' natural environment and natural selection has played no recent part in the acquirement of this character.

Summary

1. The percentage germination of 28 species of locally grown plants was determined immediately after collection and after storage at monthly intervals up to 10 months.
2. The high humidity and relatively high temperature conditions were unfavourable for the storage of seed. Only 6 species had seed which remained viable until the end of the 10 month period. There was rapid degeneration in small seed and seed of trees of Malayan origin.
3. The seeds of *Dianella ensifolia* Red. and *Asclepias curassavica* L. were not fully mature when collected and required a period of after ripening.
4. The permeability of the seeds of *Adenanthera payonina* L. and *Urena lobata* L. decreased under storage in air but the viability of the seed did not decrease since there was no change in the percentage germination of scarified seed.
5. When seeds of *Adenanthera pavonina* L. are placed in a germinator they do not all germinate immediately and may require a period exceeding a year before they have all germinated. Scarified seed all germinate within 4 days. The damp conditions render the testa more permeable in unscarified seed but the time before this occurs varies from seed to seed.

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